

STANDARD PROCEDURE H-1000

PROGRAM: **Standard Work Aids**

PROJECT: **Cost Estimating for NASA Cost Accounting
Branch (CFG)**

SUBJECT: **“Should Cost” Estimates**

Authorized by: _____
Charlotte Y. diCenzo, Cost Accounting (CFG) Branch Chief

Dated on _____

Total Pages 4

PURPOSE

The purpose for this standard procedure is to describe the basic steps used by the NASA Cost Accounting Branch (CFG) and its Cost Estimating Community (CEC) to develop “Should Costs” for use in building budgets and Independent Cost Estimates (ICEs). There are different purposes for cost estimates performed at NASA. The processes for conducting these estimates are similar and the basic analytical techniques do not vary. However, it is important to understand and recognize the differences between the purposes of estimates, the customer or requesting organization, and the use and expected result of the estimate. Space and time do not permit a detailed discussion of the different type of estimates therefore for more specific information it is suggested the reader refer to the NASA Cost Estimating Handbook April 2002 version.

For “Should Cost” estimates we use Independent Cost Estimates (ICEs) that are prepared as a result of an independent review of a program or project. The ICE is based on the same definition including Lifecycle, Work Breakdown Structure (WBS) and phases as defined in the Program LCC Estimate (i.e. in the Formulation Phase Advocacy Cost Estimates (ACEs).

NASA cost estimators often support the programs or projects during the formulation phase with a parametric cost estimate that is compared with a grass-roots estimate or a contractor estimate. Although this type of estimate is “independent” in the sense that it is developed separately from the grass-roots estimate, it’s not really an independent LCC estimate per NPG 7120.5 since the estimator is really functioning as an advocate for the program/project manager when providing this estimate. Hence, this is an advocacy estimate. Since these occur during the formulation or even pre-formulation phase in many cases, parametric cost estimating tools and techniques are typically employed to develop these estimates. These estimates may or may not include operations costs, so they might not always be traditional LCC estimates. Most important however, from the CFG perspective is the fact that these cost estimates are to include “Full Cost” budget components. These “Full Cost” budget components are now a practical requirement in order to comply with a number of laws and Federal and NASA governance. Such as the Government Performance & Results Act (GPRA) of 1993 and President Bush’s Management Agenda. Initiative of integrating budget and performance. Furthermore, the “Full Cost” approach to budgeting makes sound business sense as our economic survival involves our ability to understand the true costs of business performance while at the same time provides us with the tools to measure outputs per the Government Performance & Results Act (GPRA) of 1993.

METHODOLOGY

No matter what the components or phases of a particular program, or project are the intent of the “Full Cost Budget” is to group the budget items by the respective full cost components so that realistic costs can be accounted for across functional boundaries while still being tied to projects. The primary thrust however, is to budget in a manner such that NASA and the Office of Management and Budget will not be caught with any shortfalls in either time, money or product with respect to a given program, or project. As a result, Full Cost Budgets must be integrated with earned value methodologies which are directly involved with performance measurement and will be discussed in another procedure.

REQUIREMENTS

An Independent Should-Cost Estimate shall be performed by a person or team that does not have an investment in the project or program.

The estimate shall have a documented auditable Basis of Estimate for every element of cost.

The Basis of Estimate shall be derived from sources independent of the program or project and applied using Generally Accepted Accounting Principals (GAAP).

An Independent Should-Cost shall be performed on all programs/projects whose life cycle cost is estimated to be greater than \$150 M (NASA Appropriations Bill).

FULL COST COMPONENT DEFINITIONS (SHORT FORM)*:

*** Full Cost Class – Paul Agnew 8/22/2000**

1- Direct Costs

- Obviously and physically identified to a program
- Controllable by program or project managers
- Maximize direct charging

Examples:

- Program Unique Labor / Benefits
- Directly funded purchase requests
- Unique facility requirements

2- G&A Expenses (General and Administrative Expenses)

- Costs that benefit the entire organization
- Assignments by workforce (i.e. allocated based on direct workforce)

Examples

- G&A Unique Labor/Benefits
- Safety
- Mail Services
- Fire/Security
- Environmental
- Center Management & Staff
- Administrative ADP (Automatic Data Processing)
- G&A Facilities
- Note that these will use workforce as the method of distribution

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1. AKA: General and Administrative Overhead

The costs necessary for operations but not directly associated with developing a product or providing a service. (Source: Investor Words.com)

Full Cost Indirect Mapping

Research Operations Support (ROS)

CFO

Handicapped Access

Ctr Ops Directorate

Logistics, Emerg Prep. Fac Plan

Protective Serv/Security Invest

Dir Safety, Environ & Mission Assurance

Medical Services

FAA

Inspector General

Center Mgt. & Staff

Configuration Mgt.

Acquisitions

Human Resources Support

Bus. Sys; IT mgt. Comp Security

Indust. Hygiene & Health

Institutional Safety

US Air force Liason Office

Multi-Program Support

EEO Office

Commercial Technology

Environmental ACAP

Environmental Maint/Ops/Compliance

PKI

Bus Systems

R&T Report

CEE

Admin Aircraft Operations

Research Library

It Mgt/Computer Security

EDC/Geo Info Systems

3- Service Pools

- Subsequently linkable/assignable to programs
- Assigned based on usage or consumption (i.e. consumption based, and allocated)
- Note that these will have standard rates for like functions

Examples:

- Science & Engineering Services
- Information Technology
- Publishing Services
- Wind Tunnel Services
- Fabrication Services
- Test Services
- Facilities & Related Services

Full Cost Indirect Mapping

Research Operations Support (ROS)

Utilities

Printing & Repro

Maintenance, MFA

Telecomm

Multi-Program Support

Network Replacement

ISO 9000

Programmatic SR&QA

Utilities

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SUPERSEDES: None

Data Communications
Printing & Reproduction
EPRO
Instrumentation

Non-Cray
Photo & Imaging
Protective Relays
Maintenance

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4- Corporate G&A

5- Agency Service Pools

FULL COST DEFINITIONS

Cost – The monetary value of resources used or sacrificed, or liabilities incurred to achieve an objective such as to acquire or produce a good or to perform an activity or service.

Cost Allocations – A method of assigning costs to activities, outputs, or other cost objects. The allocation base used to assign a cost to objects is not necessarily the cause of the cost.

Cost Object (also referred to as Cost objective) – An activity, output, or item whose cost is to be measured. In a broad sense, a cost object can be an organizational division, a function, task, product, service, or a customer.

Cost Pools – A mechanism to accumulate related costs for later allocation to cost objects.

Direct Costs – Costs that are obviously and physically identified to a program and are controllable by a project manager. Under Full Cost the Center should maximize direct charging.

Full Cost – the sum of all costs (direct, service costs, and G&A) required by a cost object. The accumulation of costs by project or program provides management with the necessary information to allocate and control resources, and to track the full cost associated with an output. Full cost management involves understanding the true cost of an output and its full cost components..

General and Administrative (G&A) – Costs that are not attributable to any one project but benefit the entire organization. The Agency has determined that G&A costs will be assigned to the projects based on direct workforce.

Managerial Cost Accounting System – The organization and procedures that accumulates and reports consistent and reliable cost information and performance data to enable management and other interested parties to measure and make decisions about the organizations' ability to improve operations, control its resources, and determine if mission objectives are being met.

Outputs – Any product or service generated from the consumption of resources. It can include information or paper work generated by the completion of the tasks of an activity.

Product – Any discrete, traceable, or measurable good or service provided to a customer. Often goods are referred to as tangible products, and services are referred to as intangible products. A good or service is the product of a process resulting from the consumption of resources.

Service – An intangible product or task rendered directly to a customer.

Service Pools – costs that are not immediately identified to a project, but can subsequently be linked or assigned to projects based on usage or consumption.

Standard Costing – a costing method that attaches costs to cost objects based on reasonable estimates, or cost studies and by means of budgeted rates rather than according to actual costs incurred. The anticipated cost of producing a unit of output. A predetermined cost to be assigned to products produced. Standard cost implies a norm, or what costs should be.

Traceability – the ability to assign a cost directly to a specific activity or cost object by identifying or observing specific resources consumed by the activity or cost object.

Unit Cost – The cost of a selected unit of a good or service. Examples include dollar cost per tone, machine hour, labor hour, or department hour.

SAMPLE ILLUSTRATION OF “SHOULD COST “SPREADSHEET INDEPENDENT COST ESTIMATE

FACTS:

Source of Monies: Science Aerospace and Technologies (SAT) Appropriation and Mission Support (MS) Appropriation

Sample Operating Center Enterprise:
Science, Aeronautics & Technology (SAT) and
Mission Support (MS)

Sample Program: Engineering for Complex Systems (ECS)

Fund Source Information:

SAT(Science, Aeronautics & Technology): Fund Source 29

MS (Mission Support) Fund Source [FS – 41]

[FS-29] Direct Program Source of Funds (29/52/54 all the options)

Purchased Goods and Services dedicated to a Specific Project

Chargeback System

CoSMO

Program Support (Fund Source 9/29/52/54)

Research Facilities

MPS

Utilities

[FS-41] Mission Support R&PM (Research and Program Management) Personnel and Related Costs

- Salaries
- Benefits

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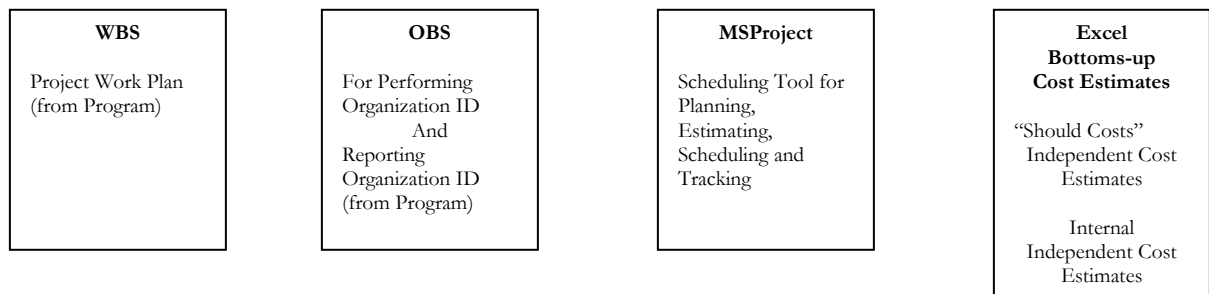
- Awards
- Training
- Transport of Household Goods

[FA-42] R & PM (Research and Program Management) Travel

- Program
- Meeting & Technical Services
- Management
- Local & Invitational

WORK FLOW

In an effort to simplify the process, it is important to note that before we build a spreadsheet for the CFG Bottoms up Cost Estimate we must build a MsProject work plan based on the information given us by the Program/Project Manager, or his/her delegate. After the proper building of same it will be much easier to build the respective Bottoms-up Cost Estimate to allocate and time phase the monies. Since work breakdown structures are very seldom are alike the person writing this procedure is not providing a sample.



Bottoms-Up Template Format

L-1 = Enterprise

L-2 = Theme (Earth Science, Earth Science Applications)

L-3 = Major Category (Development, Operations, Technology & Formulation, Research)

L-4 = Major Category Components

See also Relevant Print-out

For generic breakdown structures is the following true??

L-1 OBS (Performing Organization)

L-2 RBS (Reporting Organization), Milestones or Entire Item [entire defense materiel item]

L-3 WBS (Work Breakdown Structure) Intermediate Deliverables, or Elements [major elements]

L-4 Tasks, Deliverables or Sub Elements

SAMPLE PROGRAM USED FOR ILLUSTRATIVE PURPOSES IS

ENGINEERING FOR COMPLEX SYSTEMS

AKA: RISK MANAGEMENT FOR COMPLEX SYSTEMS

WBS	O/H Factor	FTE Hrs Per /Yr 1400	Hr Rate 40.66	PY 02 0.91	
				HRS	\$
1.0	Eng for Complex System	09/24/01	12/03/07		
1.1	Milestones				
	Formulation Studies	10/01/01	03/29/02	0	655,000
	Battelle Contract				260,000
	Risk Management				75,000
	Cost Analysis (SAIC)				25,000
	Market Survey (RIACS)				25,000
	Tech Gap Analysis				150,000
	Tech Integration Study				120,000
	Periodic Reviews			1,786	72,610
				14%	12%
	Program Readiness review	12/10/01	12/14/01	940	38,220
	NAR	05/20/02	05/21/02	279	11,340
	Enterprise Relevance Review			144	5,850
	Enterprise Relevance Review 1	10/01/01	10/01/01	144	5,850
	Enterprise Relevance Review 2	10/07/02	10/07/02		
	Enterprise Relevance Review 3	10/06/03	10/06/03		
	Enterprise Relevance Review 4	10/04/04	10/04/04		
	Enterprise Relevance Review 5	10/03/05	10/03/05		

Program Benefit Assessment			144	5,85
Program Benefit Assessment 1	01/14/02	01/14/02	144	5,85
Program Benefit Assessment 2	01/13/03	01/13/03		
Program Benefit Assessment 3	01/12/04	01/12/04		
Program Benefit Assessment 4	01/10/05	01/10/05		
Program Benefit Assessment 5	01/09/06	01/09/06		
Independent Annual Review			279	11,34
Independent Annual Review 1	07/01/02	07/01/02	279	11,34
Independent Annual Review 2	07/07/03	07/07/03		
Independent Annual Review 3	07/05/04	07/05/04		
Independent Annual Review 4	07/04/05	07/04/05		
Independent Annual Review 5	07/03/06	07/03/06		
1.2 Deliverables				
total 4QFY02	ECS-1 GPRA - Prototype Aero Sys			
	Mishap DB (RU)	09/30/02	160	165,27
		09/30/02		
	SRRM-1		160	156,50
	O/H & G&A			8,76
	Subtotal			165,27
2QFY02	ECS-2 GPRA - Model-Based BR			
	Experiment (RU)	03/30/02	0	
		03/30/02		
	RSO-1		0	
	O/H & G&A			
	Subtotal			
4QFY03	ECS-3 Organizational Risk Model	06/30/03	560	903,46
		09/30/03		
	KESS-2		0	
	O/H & G&A			
	Subtotal			
4QFY03	KESS-3		560	872,77
	O/H & G&A			30,69
	Subtotal			903,46
4QFY03	ECS-4 Initial High Dependability			
	Computing Testbeds	09/30/03	0	2,497,13
		09/30/03		
	RSO-2		0	2,497,13
	O/H & G&A			
	Subtotal			2,497,13

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4QFY04	ECS-5 GPRA - Prototype Concept Design Risk Tool	09/30/04	4,490	694,660
		09/30/04		
	SRRM-2		4,490	448,570
	O/H & G&A			246,080
	Subtotal			694,660
3QFY05	ECS-6 Virtual Iron Bird, Knowledge Engineering Systems	09/30/05	10,684	1,647,150
		06/30/05		
	KESS-1		2,550	127,260
	O/H & G&A			139,760
	Subtotal			267,020
	KESS-4		1,606	187,990
	O/H & G&A			88,020
	Subtotal			276,010
	KESS-5		6,528	746,320
	O/H & G&A			357,780
	Subtotal			1,104,100
1QFY06	ECS-7 Mishap Initiator Identification System (MIIS)	09/30/06	15,885	2,340,540
		12/31/05		
	SRRM-4		7,574	647,350
	O/H & G&A			415,110
	Subtotal			1,062,470
	SRRM-7		8,311	822,560
	O/H & G&A			455,500
	Subtotal			1,278,070
3QFY06	ECS-8 Organizational Risk Tool Suite	09/30/05	4,942	648,900
		06/30/06		
	KESS-6		0	
	O/H & G&A			
	Subtotal			
	KESS-7		4,942	378,040
	O/H & G&A			270,860
	Subtotal			648,900
4QFY06	ECS-9 Resiliant System Capabilities	09/30/07	37,294	4,441,950
		09/30/06		
	RSO-3		0	
	O/H & G&A			
	Subtotal			
	RSO-4		37,294	2,397,940
	O/H & G&A			2,044,000

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	Subtotal			4,441,95
3QFY04	RSO-7 GPRA	06/30/04	0	
	O/H & G&A			
	Subtotal			
	ECS-10 Prototype Model-Based System Analysis Tool Suite	06/30/07	44,789	7,418,14
4QFY06		09/30/06		
	SRRM-5		12,280	1,248,65
	O/H & G&A			673,04
	Subtotal			1,921,69
	SRRM-6		10,867	890,09
	O/H & G&A			595,59
	Subtotal			1,485,69
	KESS-8		0	
	O/H & G&A			
	Subtotal			
	KESS-9		0	
	O/H & G&A			
	Subtotal			
	RSO-5		7,061	1,644,68
	O/H & G&A			386,99
	Subtotal			2,031,68
	RSO-8		13,415	997,53
	O/H & G&A			735,24
	Subtotal			1,732,78
	SRRM-8		1,166	182,38
	O/H & G&A			63,90
	Subtotal			246,29
	ECS-11 High Dependability Software Standards	06/30/07	0	476,51
4QFY06		09/30/06		
	RSO-6		0	476,51
	O/H & G&A			
	Subtotal		0	476,51
	RSO-9		0	
	O/H & G&A			
	Subtotal			
	Direct Total [FS-29]		118,804	14,722,34
	O/H & G&A Total			6,511,40
	Total w/ InDirect [FS-29]s			21,233,75

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Grand Totals ECS Deliverables (Check Sum)				118,804	21,233,75
1.3	Program Management	10/01/01	04/30/07	12,938	583,24
	ECS Est				306600
	ECS Est at Net				2,146,20
	Total Civil Servants [FS-41]			9,770	397,24
	Total Support Contractor [FS-29]			3,168	180,00
	Travel [FS-42]				6,00
	Civil Servants Program Direct [FS-29]			9,310	378,54
	Civil Servants [FS-41] Code C			460	18,70
	Support Contractor [FS-29]			3,168	180,00
	Project Management	10/01/01	09/30/07	3,780	153,69
	Add Arlene				
	Business Systems	10/01/01	04/26/07	2,140	87,01
	Financial/Resourcing Accounting	10/01/02	04/30/07	1,400	56,92
Non-add	Contracting	10/01/01	09/30/07	180	7,31
	Scheduling	10/01/01	09/30/07	280	11,38
Non-add	Earned Value Management	10/01/01	09/30/04	280	11,38
	Technical Integration			7,018	336,54
	Systems Engineering	10/01/01	09/30/05	210	8,53
Direct [FS-29] Cost	Cofinguration/Document Cntr	10/01/01	09/30/06	700	15,00
Direct [FS-29] Cost	Metrics/Technical Intigration	10/01/01	09/30/07	700	15,00
	Information Architecture	10/01/01	09/30/07	1,120	45,53
Direct [FS-29] Cost	Safety R&D/Mishap Investigation	10/01/01	09/30/07	1,768	150,00
	Risk Management	10/01/01	09/30/05	1,400	56,92
	Customer Support and Advocacy	10/01/01	09/30/05	1,120	45,53
2.0	System Reasoning and Risk Management			80,780	9,155,37
	SRRM Total (RU)			80,780	9,155,37
	Civil Servants [FS-41] (RU)			8,298	380,06
	Direct Costs [FS-29] (RU)			29,386	4,903,74
	Sub-Out [FS-29] (RU)			43,096	3,871,56
	ECS Est (RU)				6,588,00
	ECS Est at Net				
	Project Management			1,400	56,92
	Project Management Budget				
	JPL Mgt Budget				174,00
	Travel [FS-42]				
	Materials [FS-29]			0	648,00
	Civil Servants Labor [FS-41]			6,898	323,14
	Support Contractor [FS-29]			29,386	3,182,75

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	Sub-Out [FS-29]			43,096	3,871,56
	Direct Costs [FS-29]			0	898,98
2.0.1	SRRM-1 Aerospace Sys Mishap Database (ASMD)		09/30/02	160	156,50
4QFY02			09/30/02		
2.0.2	SRRM-2 Prototype Risk Based Design Capability Architecture		03/30/03	4,490	448,57
2QFY03			03/30/03		
2.03	SRRM-3 Preliminary Conceptual Design Risk Tool	None B4		3,450	195,50
3QFY04			06/30/04		
2.0.4	SRRM-4 Mishap Investigation Research		10/03/04	7,574	647,35
3QFY04			06/30/04		
2.0.5	SRRM-5 Model-Based Hazard Analysis		12/31/05	12,280	1,248,65
2QFY05			03/31/05		
2.0.6	SRRM-6 Mission Risk Profiling Capability		09/30/04	10,867	890,09
1QFY06			12/31/05		
2.0.7	SRRM-7 Mishap Initiator Identification System (MIIS)		09/30/06	8,311	822,56
4QFY05			09/30/05		
2.0.8	SRRM-8 Risk-Based Design Formulation Phase Capability		12/31/06	1,166	182,38
3QFY06			06/30/06		
	Trying to do this for a sum check for L2 SRRM Milestones as there were so many changes - Total SRRM			48,298	4,591,64
2.1	Integrated Risk Mgt Technologies (RU)	11/01/06	11/01/06	36,220	3,238,13
	Civil Servants [FS-41]			978	82,43
	Direct Costs [FS-29]			43,724	4,099,77
	ECS EST				1,742,00
	ECS Est at Net				1,219,40
	Project Management				
	Civil Servants [FS-41]			978	82,43
	Materials [FS-29]			0	30,00
	Support Contractor [FS-29]			18,342	1,920,78
	Sub-Out [FS-29]			25,382	2,028,99
	Direct Costs [FS-29]			0	120,00
2.1.1	Civil Servants [FS-41]			0	
	Direct Costs [FS-29]			36,220	3,238,13
	ECS Est				1,103,00

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	ECS Est at Net				772,10
	Project Management				
	Materials [FS-29]				
	Support Contractor [FS-29]			10,838	1,209,14
	Sub-Out [FS-29]			25,382	2,028,99
	Civil Servants [FS-41]				
2.1.1	Risk Workstation	10/01/01	09/30/05	15,976	1,398,15
	Direct [FS-29]			15,976	1,398,15
2.1.1.1	EDL Test Bed	02/01/02	10/30/02	1,166	91,19
	ECS Est				100,00
	ECS Est at Net				70,00
2.1.1.2	Early phase RBD Dev/Deploy			2,420	269,96
	ECS Est				300,00
	ECS Est at Net				210,00
	JPL			1,166	91,19
	Materials [FS-29]				
	Direct [FS-29] (Support Contractor [FS-29])			2,420	269,96
IRMT-1				1,420	185,12
	Correlation Mission/Project/Architecture attributes to risk elements	10/1/01	8/30/02	2,182	185,12
IRMT-2				1,000	84,84
	Dev Methods/Comp&Contrast risk trade options	9/1/02	12/31/02		
	Prelim Int of models into RBD				
	Funtional (e.g.error budget)	10/1/01	8/30/02	500	42,42
	Reliability Models	10/1/01	8/30/02	500	42,42
IRMT-3	Int Code Q FDPP to PACT effect & failure mode analysis	9/1/02	12/31/02		
JPL	Support Contractor [FS-29]			1,166	91,19
IRMT-8	Assessment	03/01/02	06/28/02		
	Technology Selection metrics	02/01/02	04/30/02	330	27,99
	Technology Down select	05/01/02	05/30/02	100	8,48
	Process performance metrics	06/01/02	06/28/02	60	5,09
	Selected DPP Exercises Comp	06/01/02	06/28/02	60	5,09
	Interim Process Eval	07/01/02	09/30/02	220	18,66
	Develop Models	07/01/03	07/01/03		

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	Civil Servants Labor [FS-41]			175	7,11
	Support Contractor Labor [FS-29]			221	18,75
	Materials [FS-29]				
	Final Report	10/01/02	09/30/03		
	Civil Servants Labor [FS-41]				
	Support Contractor Labor [FS-29]				
IRMT-9	Integration Capability into PDC	07/01/03	09/30/03		
	Civil Servants Labor [FS-41]				
	Support Contractor Labor [FS-29]				
2.1.1.3	Risk Based Design & Analysis Tools	10/01/01	09/26/05	5,100	302,29
	Support Contractor [FS-29]			0	
ECS Est					450,00
	ECS Est at Net				315,00
IRMT-10				0	
	JPL tool deployed in CSMAD	10/01/01	05/30/02		
	Prelim Selection of tools	10/01/01	05/30/02		
	Prelim deployment, int end evel	06/04/02	09/30/02		
	Requirements Plan /Tool integration	07/01/02	09/30/02		
	Goddard			5,100	302,29
	Civil Servants [FS-41]			3,400	138,85
	Support Contractor [FS-29]			1,700	163,43
	Goddard				
IRMT-5				3,450	195,50
	Design tool trng/deploy in IDC	10/01/01	02/28/02		
	Civil Servants [FS-41]			1,200	48,79
	Support Contractor [FS-29]			650	55,14
	Gap Analysis	10/01/01	02/28/02		
	Civil Servants [FS-41]			1,000	40,66
	Support Contractor [FS-29]			600	50,90
2.1.1.4	Predicting Cost of New Tech Dev	12/31/01	09/30/05	2,070	178,61
ECS Est					180,00
JPL	ECS Est at Net				126,00
	Direct [FS-29]			2,070	178,61

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	ECS Est				180,000
	ECS Est Net				126,000
SRRM-2	Direct [FS-29]			2,070	178,610
IRMT-1	Assessment	10/01/01	12/31/01	330	27,990
	Case Studies & Customer Spr	01/01/02	07/30/02	550	46,660
	Final Report	08/01/02	09/30/02	220	18,660
IRMT-2	Model development	10/01/02	06/30/05	220	18,660
	Materials [FS-29]			750	66,620
	Verification	10/01/03	09/30/05		
2.1.1.5	Utility of Simulation design	02/01/02	09/30/02	914	77,540
	ECS Est				125,000
	ECS Est at Net				87,500
IRMT-4	Direct [FS-29]			914	77,540
	Demo end-to-end performance	02/01/02	04/30/02	350	29,690
	Demo diagnostic tool	02/01/02	04/30/02	364	30,880
	Demo error bars	02/01/02	05/15/02	200	16,960
	Complete Optimization Tools	07/15/02	07/15/02		
	Demo Optimized Tools	07/31/02	07/31/02		
	Complete Framework	08/30/02	08/30/02		
	Final report	09/30/02	09/30/02		
2.1.1.6	Integration of RBD Tools (ECS Infusion)			2,236	149,940
JPL	ECS est				110,000
	ECS est at net				77,000
	ISMR-12 Total			1,350	74,770
	ISMR-13 Total			886	75,160
ISMR-12	Int of tools into IDC environment	03/01/02	06/30/02		
	Civil Servants [FS-41]			700	28,400
	Support Contractor [FS-29]			450	38,170
	Int of tools into VSDE	03/01/02	06/30/02		
	Civil Servants [FS-41]			200	8,130
	Support Contractor [FS-29]				
ISMR-12	Deploy tools to pilot mission	07/01/02	08/31/02		
	Civil Servants [FS-41]				

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	Support Contractor [FS-29]				
ISMR-12	Science Demonstration Mission	09/01/02	12/30/02		
	Civil Servants [FS-41]				
	Support Contractor [FS-29]				
ISMR-13	Baseline current pratice	02/01/02	04/30/02	420	35,63
	Qualitative est of risk mit effectiveness	05/01/02	06/27/02	320	27,14
	Include key methods	07/01/02	09/30/02	146	12,38
	Qualitative est #2	10/01/02	06/30/03		
	Est info into DDP tool	07/01/03	09/30/04		
	Tool research continued	10/01/04	06/30/05		
	Annual update	06/30/04	06/30/04		
	Application using knowledge and tool	09/30/04	09/30/04		
	Baseline current pratice	07/01/04	09/22/04		
	Qualitative est#3	09/23/04	11/24/04		
	Include key methods	11/25/04	02/16/05		
	Qualitative est #4	02/17/05	08/31/05		
	Est info into DDP tool	09/01/05	11/23/05		
	Annual update #2	06/30/05	06/30/05		
	Application #2	09/01/05	09/30/05		
2.1.2	System Complexity Research	09/02/02	10/02/06	160	156,50
	Civil Servants [FS-41]			160	6,50
	Direct [FS-29]			0	150,00
	ECS Est				150,00
	ECS Est at Net				105,00
ISMR-2				160	156,50
	Civil Servants [FS-41]			160	6,50
	Direct [FS-29]			0	
	Materials [FS-29] (Workshop)			0	30,00
	Grants			0	70,00
	Faculty			0	50,00
2.1.2.1	NASA Workshop on Complex Systems	09/02/02	09/30/02		
	CS Hours [FS-41]			160	6,50
	Support Contractor Hours [FS-29]			0	
	Materials [FS-29]				30,00
	Grants				70,00
	Visiting Faculty				50,00
	Emperically show applicability of chosen complex measure	10/01/02	09/30/03		
	CS Hours [FS-41]				
	Support Contractor Hours [FS-29]				
	Materials [FS-29]				
	Grants				
	Visiting Faculty				
	Emperically Demo inverse approach	10/01/03	09/29/04		

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	CS Hours [FS-41]				
	Support Contractor Hours [FS-29]				
	Materials [FS-29]				
	Grants				
	Visiting Faculty				
	Test complexity measure on specific application	09/30/04	09/30/05		
	CS Hours [FS-41]				
	Support Contractor [FS-29] Hours				
	Materials [FS-29]				
	Grants				
	Visiting Faculty				
	Demonstrate Design on Application	10/03/05	10/02/06		
	CS Hours [FS-41]				
	Support Contractor Hours [FS-29]				
	Materials [FS-29]				
	Grants				
	Visiting Faculty				
<hr/>					
2.1.2.2	Risk Profile Methods	10/01/01	09/30/03	8,399	787,57
IRMT-6	ECS Est				639,00
	ECS Est at Net				447,30
	InDirect [FS-41]			818	75,93
	Direct [FS-29]			7,504	711,63
????	out-year Program Budget				
	MSR Pwr Framework	10/01/01	09/30/02	5,599	515,01
????	Missing LaRC portion				
	ARC Oversight (FS-41)			295	25,02
	(SAIC)			5,304	489,99
	Risk-Based framework			5,304	449,99
	Travel [FS-42]				30,00
	Materials [FS-29]				10,00
	Draft Plan MIIS Syst (ECS-8)	10/01/01	09/30/02	2,800	272,55
	MIIS Use Case Scenarios	10/01/01	08/31/02	NSP	NSP
	ARC Oversight(FS-41)			600	50,90
	(David Bell)			2,200	221,64
	Technical Planning			1,350	114,53
	Interviews			600	50,90
	Presentations			250	21,21
	Travel [FS-42]				30,00
	Materials [FS-29] Costs				5,00
2.2	Risk Characterization & Modeling	10/01/01	10/30/06	34,678	4,742,23
	Civil Servants [FS-41] Cost			5,920	240,70
	Direct [FS-29] Cost			28,758	4,501,53

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	ECS Est				4,380,25
	ECS Est at Net				3,066,17
	Project Management				
	Travel [FS-42]				
	Materials [FS-29]			0	618,00
	Civil Servants Labor [FS-41]			5,920	240,70
	Support Contractor [FS-29]			11,044	1,261,97
	Sub-Out [FS-29]			17,714	1,842,57
	Direct Costs [FS-29]			0	778,98
2.2.1	Model Based Hazzard Analysis	10/01/01	09/29/06	10,068	1,821,35
	Civil Service [FS-41]			0	
	Direct [FS-29]			10,068	1,821,35
	ECS Est				1,631,25
	ECS Est at Net				1,141,87
	Materials [FS-29]			0	8,00
	Civil Servants Labor [FS-41]				
	Support Contractor [FS-29]			2,652	224,99
	Sub-Out [FS-29]			7,416	1,119,90
	Direct Costs [FS-29]			0	468,45
	UNK UNK				
2.2.1.1	Validation IVHM Architechture	07/01/02	10/01/04	2,652	253,99
	Direct [FS-29]			2,652	253,99
	ECS Est				400,00
	ECS Est at Net				280,00
	Support Contractor Labor [FS-29]			2,652	224,99
	Equipment			0	8,00
	Direct [FS-29] (Student)			0	15,00
	Travel [FS-42]			0	6,00
ISMIR-6	Core DV tool demo	07/01/02	09/30/02		
	Support Contractor Labor [FS-29]			2,652	224,99
	Equipment				8,00
	Student				15,00
	Travel [FS-42]				6,00
	Guided search LPF demo	10/01/02	03/28/03		
	Support Contractor Labor [FS-29]				
	Equipment				
	Student				
	Travel [FS-42]				
	Trans Livingstone to DV tool	01/01/03	06/30/03		
	Support Contractor Labor [FS-29]				
	Equipment				
	Student				
	Travel [FS-42]				

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	Demo scenarios in LPF	01/01/03	03/30/04		
	Support Contractor Labor [FS-29]				
	Equipment				
	Student				
	Travel [FS-42]				
	Integrate DV tool	03/31/04	06/30/04		
	Support Contractor Labor [FS-29]				
	Equipment				
	Student				
	Travel [FS-42]				
	Demo pruning LPF	07/01/04	09/30/04		
	Support Contractor Labor [FS-29]				
	Equipment				
	Student				
	Travel [FS-42]				
	Assist generation diag props (opt I)	07/01/04	09/30/04		
	Support Contractor Labor [FS-29]				
	Equipment				
	Student				
	Travel [FS-42]				
	Assist generation of LPF scenarios (Opt II)	07/01/04	09/30/04		
	Support Contractor Labor [FS-29]				
	Equipment				
	Student				
	Travel [FS-42]				
ISMR-9	Final Report	08/01/04	09/30/04		
	Support Contractor Labor [FS-29]				
2.2.1.2	Hazzard Anal for Interactive Sys	10/01/01	09/29/06	3,080	248,93
	ECS Est				293,00
	ECS Est at Net				205,10
	JSC Sub out				
	Civil Servants [FS-41]			280	11,38
	Direct Labor [FS-29]			2,800	237,55
ISMR-6	PY 02				
	Study of Process tool int approach	10/01/01	05/30/02		
	Civil Servants Labor [FS-41]			100	4,06
	Support Contractor [FS-29]			1,000	84,84
	Initial Model library/Assy	03/04/02	07/30/02		
	Civil Servants Labor [FS-41]			100	4,06
	Support Contractor [FS-29]			1,000	84,84
	Initial Model library/Hazard ID Tool	05/01/02	08/28/02		
	Civil Servants Labor [FS-41]			60	2,44
	Support Contractor [FS-29]			600	50,90
ISMR-9	Demonstrate init simulation	09/02/02	09/30/02		
	Civil Servants Labor [FS-41]			20	81
	Support Contractor [FS-29]			200	16,96

2.2.1.3		MIT/UofMaryland Model-Based hazard Analysis					256,91
ISMR-5 (yrs 2,3,4)		ECS Est					508,25
ISMR-9 (05-07)		Ecs Est at Net					355,77
		MIT Research Project	03/04/02	09/30/04			256,91
		ECS Est					356,25
		ECS Est at Net					249,37
		State Machine Models	03/04/02	09/01/04			
		Accident Models	03/04/02	09/01/04			
		Final report	09/30/04	09/30/04			
2.2.1.4		Real Time Risk Monitoring (EOOS PRA)					70,00
ismr-11		ECS Est					100,00
		ECS Est at Net					70,00
		JSC					
		Research Paper		09/30/02			70,00
2.2.1.5		SIM Model Space Station		10/01/01	07/31/02	1,768	149,99
ISMR-5		ECS Est					230,00
		ECS Est at Net					161,00
2.2.1.4		Sim Station LaRC					
ISMR-11		JSC Sub-Out [FS-29]					
		Delivery of RBDA 12A.1 Tool	10/01/01	10/01/01			
		EOOS Tool Model	10/03/01	07/31/02	1,200		101,80
		Recommendations/Improvements	10/02/01	07/29/02	568		48,18
2.2.2		Mishap Investigation Research		03/01/02	10/30/06	18,215	2,085,24
		Civil Servants [FS-41]				3,500	142,31
		Direct [FS-29]				14,715	1,942,93
ECS Est							1,837,00
		ECS Est at Net					1,285,90
		Civil Servants [FS-41]				3,500	142,31
		Support Contractor [FS-29]				4,417	699,73
		Materials [FS-29]				0	330,00
		Sub-Out [FS-29]				10,298	722,66
		Other Direct Costs [FS-29]				0	190,53

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2.2.2.1	Mishap Investigation Research			1,842	144,42
	Civil Servants [FS-41]			1,400	56,92
	Direct [FS-29]			442	87,49
	ECS Est				175,00
	ECS Est at Net				122,50
	Civil Servants [FS-41]			1,400	56,92
	Support Contractor [FS-29]			442	37,49
	Materials [FS-29]			0	50,00
	Map & Assess problem/Viable approach	10/01/01	12/27/03		
	CS Hours [FS-41]			700	28,46
	Support Contractor [FS-29]			42	3,56
	Materials [FS-29]				25,00
	Document/assess mishap investigation process	01/01/02	06/30/03		
	CS Hours [FS-41]			700	28,46
	Support Contractor [FS-29]			400	33,93
	Materials [FS-29]				25,00
	Methods and Tools introduced	07/01/03	06/30/04		
	CS Hours [FS-41]				
	Support Contractor [FS-29]				
	Materials [FS-29]				
	Assess applicability of accident models	07/01/04	09/30/05		
	CS Hours [FS-41]				
	Support Contractor [FS-29]				
	Materials [FS-29]				
	Anomaly resolution techniques	10/03/05	10/30/06		
	CS Hours [FS-41]				
	Support Contractor [FS-29]				
	Materials [FS-29]				
2.2.2.2	CAUSE: Causality Analysis Using Symbolic Expression			1,492	130,19
	ECS Est				150,00
	ECS Est at Net				105,00
	LaRC Subout			1,492	130,19
ISMR-10	Determine if tool exists	03/01/02	09/26/02		
	CS Hours [FS-41]			1,050	42,69
	Support Contractor [FS-29]			442	37,49
	Materials [FS-29]				50,00
ISMR-10	Design Prototype	10/16/02	09/30/03		

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	CS Hours [FS-41]		
	Support Contractor [FS-29]		
	Materials [FS-29]		
ISMR-10	Demonstrate Prototype	10/17/03	09/30/04
	CS Hours [FS-41]		
	Support Contractor [FS-29]		
	Materials [FS-29]		
ISMR-15	Design integrated tool suite	10/18/04	09/30/05
	CS Hours [FS-41]		
	Support Contractor [FS-29]		
	Materials [FS-29]		
ISMR-15	Demonstrate prototype tool suite	10/17/05	09/29/06
	CS Hours [FS-41]		
	Support Contractor [FS-29]		
	Materials [FS-29]		

2.2.3 RPM**2.2.3.1 SW Risk Characterization****2.2.3.2 Risk Profile Methods**

2.2.3.3	U of Maryland Research Project	11/15/01	11/05/04	190,530
	ECS Est			152,000
	ECS Est at Net			106,400

Concept Design Phase (I)	11/15/01	09/26/02
Prototype development (II)	10/01/02	09/30/03

2.2.3.4 Decision Capture Application**2.2.3.5 Risk Characterization and Assessment**

2.2.3.6	ISS EPS Analysis	10/02/01	09/30/05	2,468	178,450
	ECS Est				200,000
	ECS Est at Net				140,000

Glenn Sub Out

Civil Servants [FS-41]	700	28,400
Direct [FS-29]	1,768	149,990

Int SPACE EPS and FPI S/W	10/02/01	08/30/02	
ISMR-3		2,468	178,450

Prelim Report	07/01/02	09/30/02	
Civil Servants Labor [FS-41]		700	28,400
Support Contract Labor [FS-29]		1,768	149,990

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ISMR-5

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PY 03 Analysis	12/25/02	09/30/03
Civil Servants Labor [FS-41]		
Support Contract Labor [FS-29]		
PY 04 Analysis	12/26/03	09/30/04
Civil Servants Labor [FS-41]		
Support Contract Labor [FS-29]		
PY 05 Analysis	12/27/04	09/30/05
Civil Servants Labor [FS-41]		
Support Contract Labor [FS-29]		

2.2.4**Mishap Initiator ID Sys****10/01/01****12/31/04****6,075|****697,62**

Civil Servants [FS-41]
Direct [FS-29]

2,100|
3,975|

85,38
612,23

ECS Est**ECS Est at Net**

762,00
533,40

Project Management
Travel [FS-42]
Materials [FS-29]/Subcontract Software
Development/System Integration
Civil Servants Labor [FS-41]
Support Contractor [FS-29]
Sub-Out [FS-29]
Direct Costs [FS-29]
UNK UNK

2,100|
3,975|

250,00
85,38
337,23

25,00

PY 02

ISMR-4**3,365|****357,47**

MIS Planning	10/01/01	09/26/02
Civil Servants Labor [FS-41]		
Support Contractor [FS-29]		
Define aerospace taxonomies	10/01/01	03/01/02
Civil Servants Labor [FS-41]		
Support Contractor [FS-29]		
Mishap/Accident report Archive	03/01/03	07/26/02
Civil Servants Labor [FS-41]		
Support Contractor [FS-29]		
Materials [FS-29]		

450
740

18,29
62,78

300
575

12,19
48,78

450
850

18,29
72,11

125,00

ISMR-8**2,710|****315,15**

Excel -Based Mishap Analysis	08/01/02	07/26/02
Civil Servants Labor [FS-41]		
Support Contractor [FS-29]		
ECS-1 Infrastructure	08/01/02	09/26/02
Civil Servants Labor [FS-41]		

450
950

18,29
80,59

450

18,29

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	Support Contractor [FS-29]			860	72,96
	Materials [FS-29]				125,00
ISMR-1				0	
	PY 03				
	Tasks?	10/01/02	09/30/03		
	Civil Servants Labor [FS-41]				
	Support Contractor [FS-29]				
	Materials [FS-29]				
ISMR-13				0	
	PY 04				
	Mishap Investigation Research	10/01/03	06/30/04		
	Civil Servants Labor [FS-41]				
	Support Contractor [FS-29]				
	Materials [FS-29]				
IRMT-7				0	
	PY 05	10/01/04	12/31/04		
	Risk Signature Tools	10/01/04	12/31/04		
	Civil Servants Labor [FS-41]				
	Support Contractor [FS-29]				
	Materials [FS-29]				
2.2.5	Propulsion Subsystem Modeling	10/01/01	09/30/05	6,338	414,01
ECS Est	Glenn Sub-Out [FS-29]				600,00
	ECS Est at Net				420,00
2.2.5.1	Integrated Life prediction				
ECS Est	Modeling/Propulsion Sys	10/01/01	10/01/05	3,168	206,92
	ECS Est at Net				400,00
	Glenn Sub Out				280,00
	InDirect Labor [FS-29]			1,400	56,92
	Direct [FS-29]			1,768	149,99
	Refine algorithms	10/1/01	7/26/02		
	Civil Servants Labor [FS-41]			1,160	47,16
	Support Contract Labor [FS-29]			1,473	124,96
	Analysis thermal xfer	8/1/02	9/30/02		
	Civil Servants Labor [FS-41]			240	9,75
	Support Contract Labor [FS-29]			295	25,02
2.2.5.2	Integrated Modeling Propulsion Sys	10/01/01	09/30/05	3,170	207,09
ECS Est	ECS Est at Net				200,00
	Glenn Sub-Out [FS-29]				140,00
	Civil Servants [FS-41]			1,400	56,92
	Direct [FS-29]			1,770	150,16

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	Matrices	10/01/01	06/27/02		
	Civil Servants Labor [FS-41]			1,050	42,69
	Support Contractor Labor [FS-29]			1,323	112,24
	Materials [FS-29]				
	Controller design	07/01/02	08/30/02		
	Civil Servants Labor [FS-41]			240	9,75
	Support Contractor Labor [FS-29]			300	25,45
	Materials [FS-29]				
	Complete Controller	09/02/02	09/30/02		
	Civil Servants Labor [FS-41]			110	4,47
	Support Contractor Labor [FS-29]			147	12,47
	Materials [FS-29]				
<hr/>					
3.0	Knowledge Engineering for Safety and Success	10/01/03	09/30/04	24,970	3,004,07
	KESS Total (RU)			24,970	3,004,07
	Civil Service [FS-41] (RU)			6,560	266,73
	Direct Costs [FS-29] (RU)			10,646	2,023,70
	Sub-Out [FS-29] (RU)			7,764	713,64
	ESC Est				4,936,00
	ECS Est at Net				3,455,20
	Program Management			1,400	56,92
	Materials [FS-29]			0	1,120,50
	Civil Service [FS-41]			5,160	209,80
	Support Contractor [FS-29]			10,646	903,20
	Sub-Out [FS-29]			7,764	713,64
	Direct Costs [FS-29]			0	
3.0.1	KESS-1 Standard Engineering Objects Framework	10/01/04	09/30/05	2,550	127,26
4QFY02			09/30/02		
3.0.2	KESS-2 Organizational Risk Model-Defined	10/01/01	09/29/06	0	
1QFY03			12/31/02		
3.0.3	KESS-3 Organizational Risk Model-Validated	02/01/02	12/31/03	560	872,77
3QFY03			06/30/03		
3.0.4	KESS-4 Engineering Objects for Digital Shuttle- Prototype Deployed	01/01/04	07/16/04	1,606	187,99
3QFY04			06/30/04		
3.0.5	KESS-5 Virtual Iron Birds: Integration Plan	12/28/04	03/29/06	6,528	746,32
2QFY05			03/31/05		
3.0.6	KESS-6 Organizational Risk Tool - Architecture Defined	10/22/01	03/29/04	0	

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2QFY05			03/31/05		
3.0.7	KESS-7 Organizational Risk Tool - Demonstration and Initial Technology Transfer Report	06/23/03	03/29/04	4,942	378,04
1QFY06			12/31/05		
3.0.8	KESS-8 Integrated Assessment of Organizational Risk Tools and Models	02/01/02	09/29/06	0	
3QFY06			06/30/06		
3.0.9	KESS-9 Integrated Virtual Iron Bird - Architecture Complete	04/01/04	03/31/06	0	
3QFY06			06/30/06		
	KESS-10 VIRTUAL IRON BIRD - Architectural Assessment and Implementation Plan			0	
3QFY07			06/30/07		
	KESS-11 Organizational Risk Tool Suite-Next Generation Architecture Defined			0	
3QFY07			06/30/07		
	Total KESS			16,186	2,312,39

NECESSITY

The use of a standard numbering format for cost estimation that relates directly to the Work Breakdown Structure (WBS) numbering format is required to ensure:

- The program or project can identify discreet costs associated with tasks or milestones
- Estimators and managers can perform "What-If" scenarios, expanding or contracting requirements, for cost impact
- Comply with NASA Full-Cost requirements